NASA Facts ON LINE

AMES RESEARCH CENTER

National Aeronautics and Space Administration

Ames Research Center, Moffett Field, California 94035-1000

415-604-9000

FS-ARC-010

Supercomputer Research

Ames Research Center, Mountain View, Calif. is NASA's lead center for supercomputer research. Ames' supercomputers are the most advanced in the aerospace field.

In 1993, Ames added a new Cray Y-MP C90 supercomputer -- the world's fastest -- to its system. The new $49 million supercomputer increases the power of the system by more than six times. The C90 routinely performs more than six billion calculations per second. It has a memory capacity of one billion words.

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The world's fastest supercomputer, the $48 million Cray Y-MP C90, routinely performs six billion calculations per second and has a memory capacity of one billion words. It is one of several supercomputers located at NASA's Ames Research Center, Mountain View, Calif. Photo No. A94-0200-1. Credit to NASA Ames Home Page.

Jpeg PUBLICATION SIZE IMAGE, 255 k. Decompresses to 7.91 Meg, 9.4" X 7.4", 200 dpi.

The C90 has 16 processors and a peak speed of 16 billion floating point operations per second (FLOPS). A floating point operation is the addition, subtraction or multiplication of two numbers. Scientists calculate a

supercomputer's speeds on its sustained execution rates, not on theoretical maximum speeds for new computer hardware. Like many other supercomputers, the C90 uses Unix software.

The C90 is one of several supercomputers located in Ames' Numerical Aerodynamic Simulation (NAS) facility. NAS is a national supercomputer facility linked to more than 1,200 industry, university, government and NASA scientists by its national computer network called AERONet.

The NAS Program was created in 1983 to ensure America's continuing leadership in computational fluid dynamics. Today, it is internationally recognized as a leader in large-scale scientific computing.

NAS Program scientists conduct aerodynamics and hypersonic flight research.

PICTURE OF RESEARCHER TO BE ADDED HERE AT A LATER DATE.

A researcher at NASA's Ames Research Center is shown working on a graphics work station in the center's Numerical Aerodynamics Simulation (NAS) facility.

They use supercomputers to solve complex aerodynamic equations to test aircraft designs by simulating aircraft in flight.

Supercomputers provide scientists with several possible solutions to the same aircraft design problem. This is often cheaper and more effective than traditional wind tunnel testing.

NAS Program scientists work in a 90,000-square-foot facility which includes a 14,000-square-foot central computer room. Its climate cooling system is 28 times more powerful than that of a similar-sized office building.

In addition to the new C90, the NAS facility also contains several other high speed computers and a data storage system. The NAS facility contains an Intel iPSC/860, an Intel Paragon, a Sun SPARCcenter 2000 and a Thinking Machines CM-5. It also contains two Convex C3820, a Convex C3240, four Silicon Graphics 4D/380S and eight StorageTek 4400 Tape Robots for data storage.

IMAGE OF YAV-8B HARRIER GRAPHIC TO GO HERE AT A LATER DATE.

This computational simulation depicting airflow pressures around a YAV-8B Harrier vertical takeoff and landing aircraft was created by Merritt Smith., Kalpana Chawla and William Van Dalsem at NASA's Ames Research Center. The Harrier is shown traveling at a speed of 30 knots at an altitude of 30 feet. Four nozzles on the sides of the aircraft turn the engine exhaust to provide the thrust necessary for vertical take-off and hover.

By the year 2000, scientists say NAS' supercomputers will be able to compute one trillion operations per second. This would represent a 1000-fold speed increase over 1990's most powerful computers. To accomplish this, the NAS Program is committed to achieving a teraFLOPS computing capability, (a sustained computing rate of one trillion floating-point operations per second.)

The teraFLOPS supercomputer would require trillions of words of mass storage, multi-gigabit-per-second

networks and advanced visualization systems for full utilization of its capabilities. The new teraFLOPs supercomputer will also need new software and application programs.

NAS scientists say the "wave of the future" in supercomputers is highly parallel computers. Ames now has three experimental "highly parallel computers." Highly parallel computers are those with at least 32 processors; often they have more than 100 processors. In 1993, Ames' parallel computers and research techniques achieved record speeds of five billion CPS on flight aerodynamics problems.

IMAGE OF V22 TILTROTOR SIMULATION TO BE ADDED HERE AT A LATER DATE.

This computational simulation depicting unsteady flow simulation around a V22 Tiltrotor was created by Robert L. Meakin at NASA's Ames Research Center. The aircraft is shown in a low speed, forward flight takeoff mode. Particles released aft of the blade tips show the interaction between the blade vortices and the V22 fuselage.

Ames and other supercomputer centers are redesigning computation schemes and software for highly parallel computers. The "solution algorithms" (computer arithmetic) must closely match parallel computer architecture. Likewise, the computers must meet the demands of various types of computation.

Although Ames Research Center specializes in aerodynamics research, scientists use supercomputers for other research ranging from computational chemistry to astrophysics. Scientists use supercomputers to make detailed calculations of possible chemical compounds and sequences of reactions. Scientists then simulate those reactions in the supercomputer.

Scientists also use supercomputers to develop weather and climate models and to re-create geological strata. They also use supercomputers to calculate flow in star interiors and interstellar gas clouds and collisions in galaxies.

For further information, contact:

Media Services Office, NASA Ames Research Center, MS 204-12

Moffett Field, CA 94035-1000

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